AN OVERVIEW OF KINGDOM PLANTAE

Diversity and Habitats

- The kingdom Plantae, also known as the plant kingdom, is incredibly diverse and includes hundreds of thousands of distinct species.
- These plants can be found in a wide range of habitats, from the freezing Arctic tundra to lush tropical rainforests and arid deserts.

Evolution and Migration to Land

- Initially, plants were restricted to aquatic environments. The migration of plants to land began nearly **400 million years** ago.
- Biologists have identified the freshwater green algae *Charophyceae* (a group of algae), such as ***Chara***, a pond organism, as the closest relatives of land plants.

Science Titbits

Both the true plants and Charophycean algae contain a higher percentage of cellulose than the cell walls of Charophycean algae. The flagellated sperm of plants closely resembles that of charophycean sperm. Comparisons of both nuclear and chloroplast genes agree that charophyceae as the closest relatives of land plants. It does not mean that these algae are the ancestors of plants however, both have evolved from a single common ancestor (show monophyletic lineage).

Diagnostic Features of Plants

Multicellularity and Structure

- Plants are multicellular eukaryotes with well-developed tissues.
- They have a plant body consisting of roots, stems, and leaves, which contain vascular tissues (**xylem** and **phloem**) and cellulose-rich cell walls.

Autotrophic Nutrition

- Plants possess autotrophic nutrition, meaning they produce their own food through photosynthesis.

Protection Against Desiccation

- Plants are well protected from drying out in air by their cuticle, which is formed from a waxy substance called cutin.

Alternation of Generations

- Heteromorphic alternation of generations refers to a life cycle in plants (and some algae) where the organism alternates between two distinct multicellular stages that differ in morphology (form and structure).
- Plants show heteromorphic alternation of generations. They alternate between two distinct phases sporophyte and gametophyte.
  - **Sporophyte Generation:** The diploid generation produces haploid spores by meiosis. These spores develop into the haploid generation.

- **Gametophyte Generation:** The haploid generation has multicellular sex organs that produce morphologically and physiologically different gametes (**oogamous**). These gametes unite to form a diploid zygote.

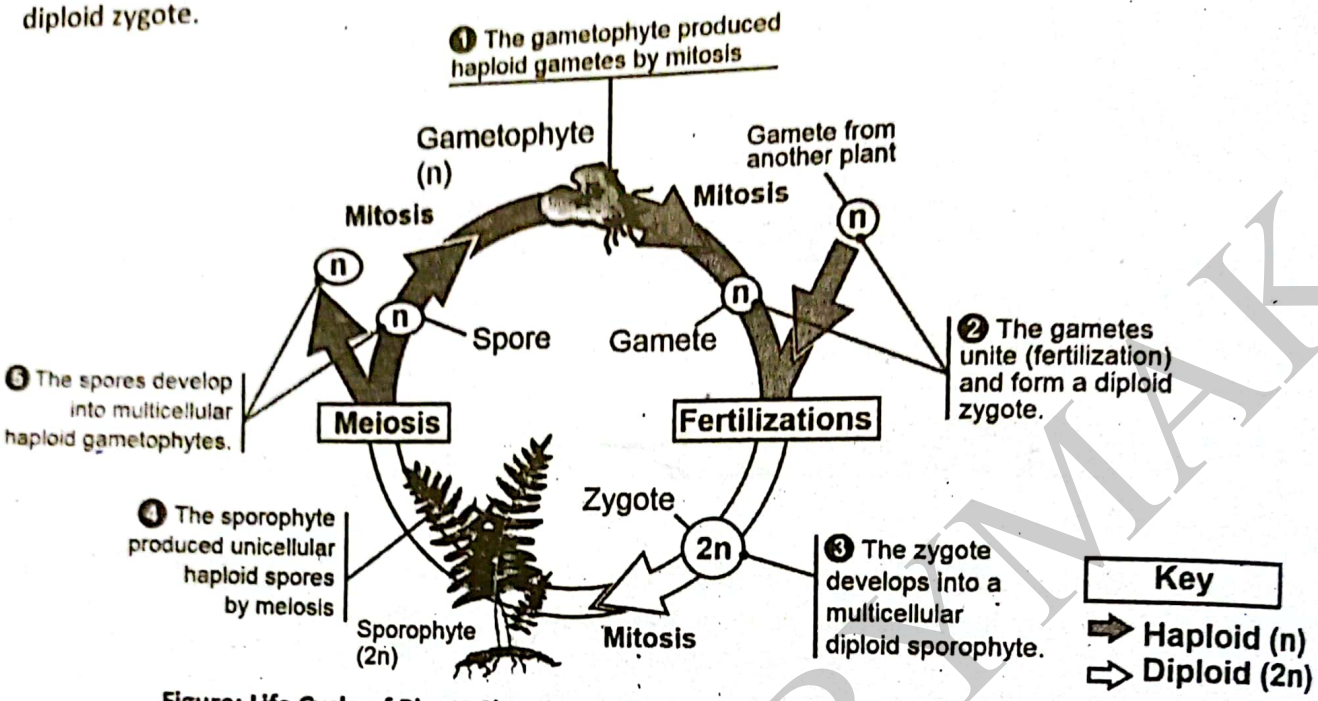


Figure: Life Cycle of Plants Showing Heteromorphic Alternation of Generation

Classification of Kingdom Plantae

Phylogenetic Classification

- The Kingdom Plantae is divided into two main groups: Bryophytes and Tracheophytes.

Bryophytes (Non-Vascular Plants)

- Bryophytes include Liverworts, Mosses, and Hornworts.
- They lack specialized tissues for efficient water and nutrient transport.

Tracheophytes (Vascular Plants)

- Tracheophytes are divided into two primary sister groups: Lycophytes and Euphyllophytes.

Lycophytes

- Lycophytes include clubmosses and their relatives.

Euphyllophytes

- Euphyllophytes consist of ferns, horsetails, and seed plants.
- Lycophytes, ferns, and horsetails are collectively known as pteridophytes, which are free-sporing vascular plants with shared ancestral characteristics.

Comparative Structures

- When discussing sporophyte structure, pteridophytes (a paraphyletic group) are compared to spermatophytes (seed plants, a monophyletic group) to understand evolutionary relationships.

Seed Plants (Spermatophytes)

- Seed plants are further divided into Gymnosperms and Angiosperms.

Gymnosperms

- Gymnosperms are non-flowering seed plants.

Angiosperms

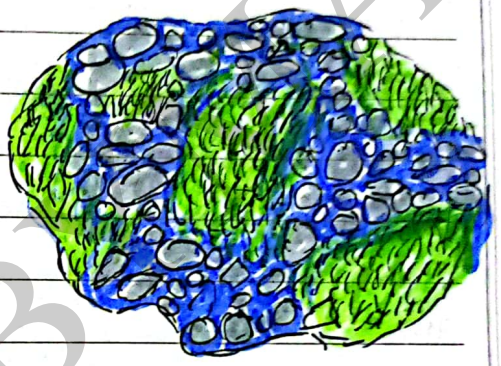
- Angiosperms are flowering seed plants.
- Angiosperms have unique structural traits that set them apart from gymnosperms.

Chapter #08

Kingdom Plantae

Bryophytes:-

→ non vascular plants.



→ Very small, a few reach at 2cm
→ first land plants (envolve) from algea
→ damp and shaddy places
→ Amphibians plants → During reproduction → gamete has to swim water is required to reach the female gamete
→ Root like, leafe like, stem like structures are present
→ No vascular bundles → rhizoids (Roots like structure)
→ Alternation of generation
→ Gametophyte is dominent (perform Photosynthesis)
→ Sporophyte is enclosed in gametophyte.

Land adaptations:-

① Compact multicellular body + cuticle layer → miniminze water loss
② Speacial chambers are present for photosynthetic tissue
③ Rhizoid → for anchorage & water absorption
④ Hetrogamy and oogamy ⑤ Antheridia and archegonia
⑥ Multicellular embryo develop inside archegnium
⑦ alternation of generation

TRACHEOPHYTA (VASCULAR PLANTS)

- *Tracheophytes* are vascular plants that possess xylem and phloem for the conduction of water, minerals, and organic solutes.
- They are called tracheophytes because **tracheids** are found in the xylem of all these plants.

Characteristics of Tracheophytes

- This group of land plants is highly successful, with flowering plants being particularly dominant in today's land habitats.

- This success can be attributed to the evolution of the following complex vegetative and reproductive characteristics:

1. **Main Plant Body (Sporophyte)**
   - The main plant body is the **sporophyte**, which consists of roots, stems, and leaves. These structures contain vascular systems.
2. **Evolution of Protected Sporangia**
   - The evolution of protected sporangia led to the development of seeds. Developmentg of seed played a crucial role in the success of tracheophytes.
3. **Adaptation of Pollen Tube**
   - The adaptation of a pollen tube facilitated the safe and water-independent transmission of male gametes to female gametes.
4. **Presence of Flowers and Fruits**
   - The presence of flowers and fruits further enhanced reproductive success by attracting pollinators and protecting seeds.
5. **Heteromorphic Alternation of Generations:**
   - Tracheophytes exhibit heteromorphic alternation of generations, providing flexibility in adapting to various terrestrial conditions.

Subdivisions of Tracheophytes

- Tracheophytes are further classified into four subdivisions:
  1. **Psilopsida:** An ancient group of vascular plants, often called whisk ferns.
  2. **Lycopsida:** Includes club mosses and their relatives, characterized by microphyll leaves.
  3. **Sphenopsida:** Comprising horsetails known for their jointed stems and silica deposits.
  4. **Pteropsida:** The largest and most diverse group, including ferns, gymnosperms, and angiosperms.

Pteridophyta:-

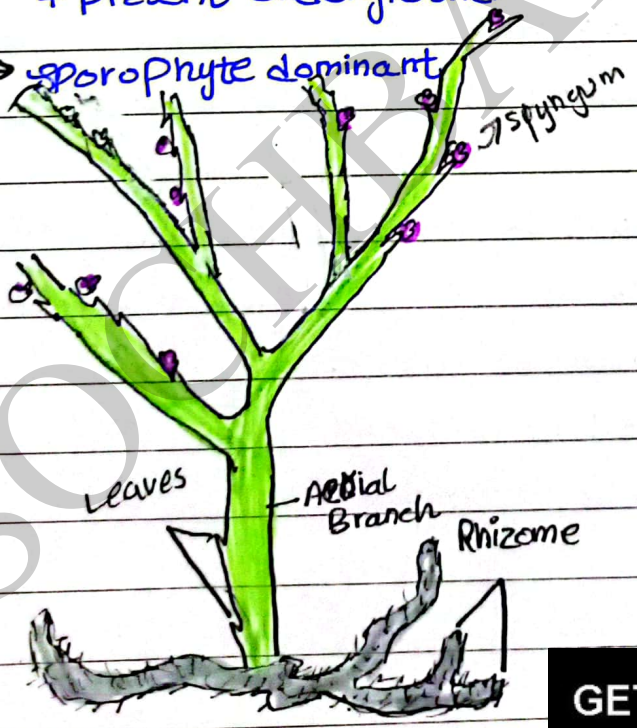
vascular plants

Psilopsida | Lycopsida | Sphenopsida | Petrosida

Psidopsida

whisk fern

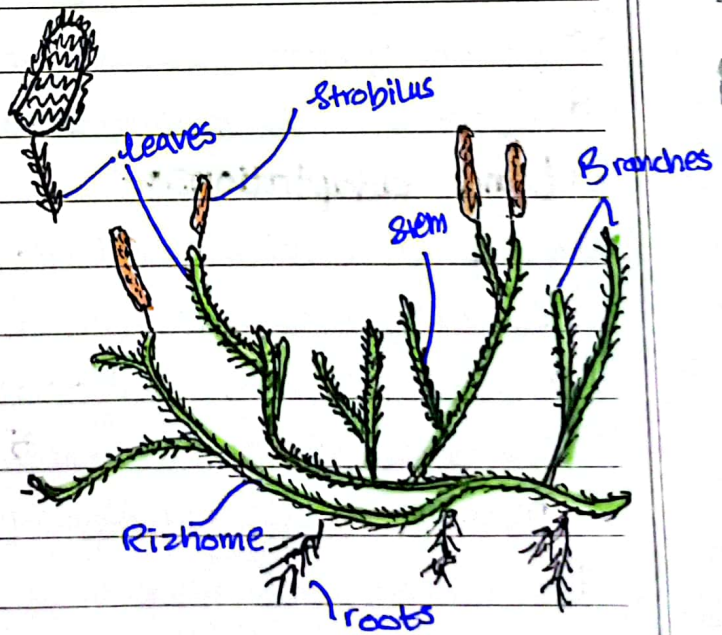
- Earliest vascular plant
- Extinct → Rhynia, Cooksonia
- Living → Psilotum, Tmesipteris
- Rootless, leafless (Root like, Leaflike structures)
- Green stem (fork leaves)
- Rhizome (underground stem)
- Rhizoids (function like roots)
- undifferentiated gametophyte + present underground
- sporophyte dominant



Lycopsida

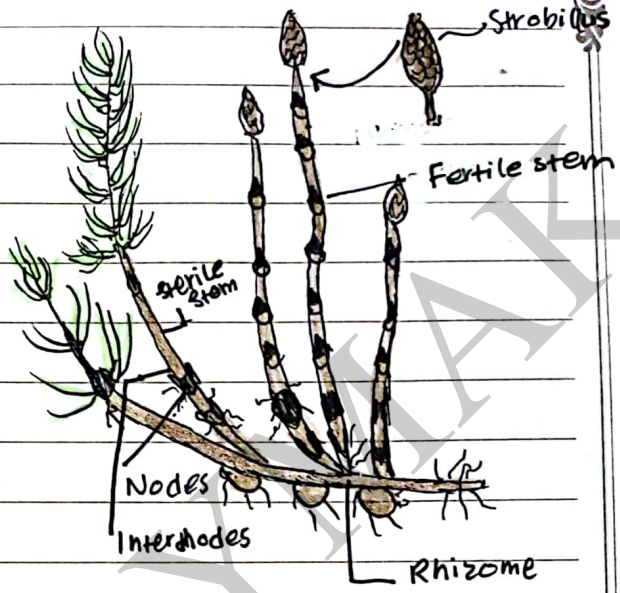
clubmosses

- Sporophyte plant (sporophyte dominant)
- Leaves → microphylls
- gametophyte underground
- Rhizome (underground stem)
- lycopodium → Homospourus → same type spores
- → Hetrosporus → different type spores
- Cluster of leaves → Strobilli



Sphenopsida:-
Horsetail

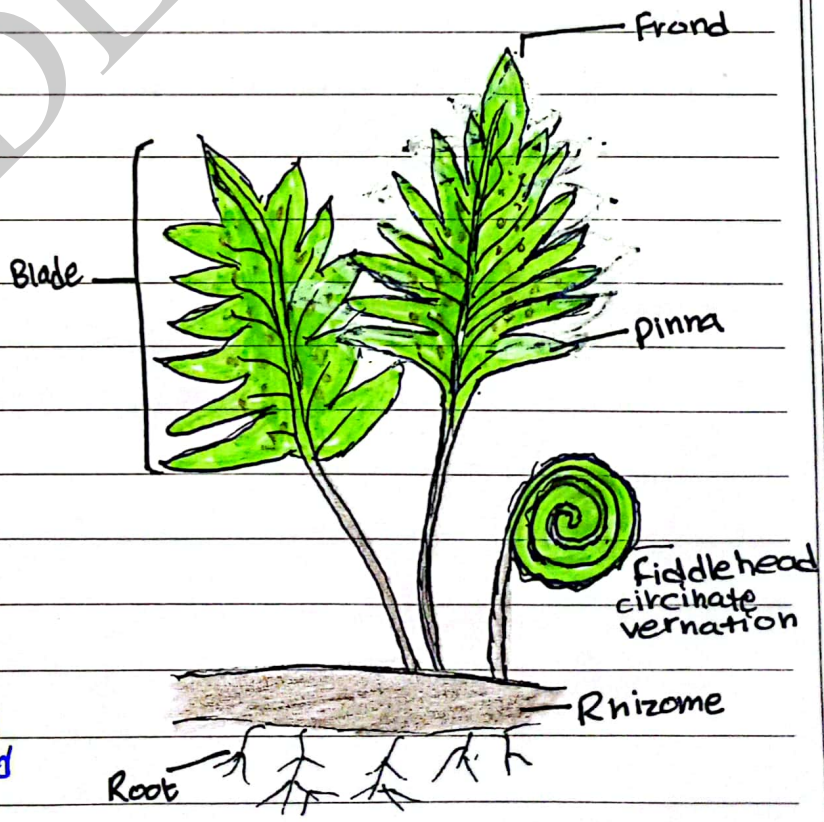
→ Arthrophytes joined stems nodes and internodes
→ waste and moist envoirment
→ Living → equisetem → genus
→ genus → Equisetum
→ developed from rhizome (fertile, sterile)
→ spores → produced rings of sporangia



Petropsida:-

Filliciane
Gymnosperm
Angiosperm

Seedless
Vasula bundles are present
ferns (Adiantum)
warm and moist regoin
1cm to 24 cm tall - Leaf 5cm broad
usually homosphore/ but occasionally heterospore
sporophyte dominant
sporangia is foliar (present on the tip of leaf)
fronds → Reproduction
→ photosynthesis
circinate vernation → coiled than they become flattned
Sori → group of sporangia



Angiosperms:-

→ Angiosperms or flowering plant are diverse group of plant known for having their seed enclosed within fruits

→ The name "angiosperms" literally means "enclosed seed" The word "angio" means closed and "sperm" meaning "seed".

→ The key productive structures of angiosperms are their flowers, which specialized leaves containing ovules

→ These leaf structure come together and fold at their edges to form what is known as ovaries within the flowers. Once fertilization occurs, ovaries → fruits.

→ It have well developed vascular system. Unlike gymnosperms → vessels and fibers in xylem and phloem

→ This group → extensive and successful.

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